ESA Recovery Planning for Mid-Columbia River Steelhead in the Gorge Management Unit

Status of Planning Effort and Strategy for Completing Plans

January 19, 2006

Contents

Introduction

This document describes the status of efforts and the strategy for completing a draft interim regional recovery plan for the Middle Columbia River steelhead (*Onchorhynchus mykiss*) in the Gorge Management Unit of southeastern Washington. The Middle Columbia steelhead evolutionarily significant unit (ESU)[1] is listed as threatened under the U.S. Endangered Species Act of 1973 (ESA). Although NMFS is the agency responsible for recovery planning for salmon and steelhead, NMFS believes that local support of recovery plans is essential to their success, and is therefore committed to involving local citizens in development of the plans. Accordingly, NMFS, the Yakama Nation, Klickitat County, and the State of Washington have been working together to develop and write a plan for Middle Columbia River steelhead that will meet ESA requirements for recovery plans.

ESA Recovery Planning

The ESA requires that a recovery plan be developed and implemented for species listed as endangered or threatened under the statute. These plans must, at a minimum, contain (1) a description of site-specific management actions necessary to achieve the plan's goal for the conservation and survival of the species; (2) objective, measurable criteria which, when met, would result in a determination that the species be removed from the list; and (3) estimates of the time required and cost to carry out the measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal (section 4(f) of the ESA). Recovery criteria must include not only biological criteria but also criteria that address the threats to a species (i.e., listing factors in ESA section 4[a][1]). Although the plans are guidance documents, not regulatory, the authors of the ESA clearly saw recovery plans as a central organizing tool for the recovery of listed species.

Recovery Domains and Management Units

The Interior Columbia Basin is one of four "recovery domains" that NMFS has delineated throughout Washington, Oregon, and Idaho to organize recovery planning for ESUs currently listed throughout the region (Figure 1). The Middle Columbia is a sub-domain of the Interior Columbia. The Interior Columbia Basin is currently home to 12 anadromous salmonid ESUs, including the Middle Columbia River steelhead ESU. Since 1991, seven of these ESUs have been listed as threatened or endangered under the ESA.

Because most state and local boundaries are not drawn on the basis of watersheds or ecosystems, the various groups and organizations formed for recovery planning do not

[1] An ESU is a group of salmon or steelhead that is (1) substantially reproductively isolated from other groups and (2) represents an important component of the evolutionary legacy of the species (Waples 1991). The ESA allows listing decisions to be made at the scale of a species, sub-species, or distinct population segment (see definition of species at ESA section 3[15]). For Pacific salmon and steelhead, NMFS has defined distinct population segments as ESUs (56 FR 58612).

necessarily correspond to ESU areas. Therefore, in order to develop ESU-wide recovery plans that are built from local recovery efforts, NMFS defined management units that roughly follow jurisdictional boundaries but, taken together, encompass the geography of entire ESUs (see Figure 2). For Middle Columbia steelhead, there are four management units: 1) Oregon; 2) Yakima; 3) Columbia Gorge (Klickitat/Rock Creek/White Salmon); and 4) S.E. Washington (Walla Walla and Touchet).

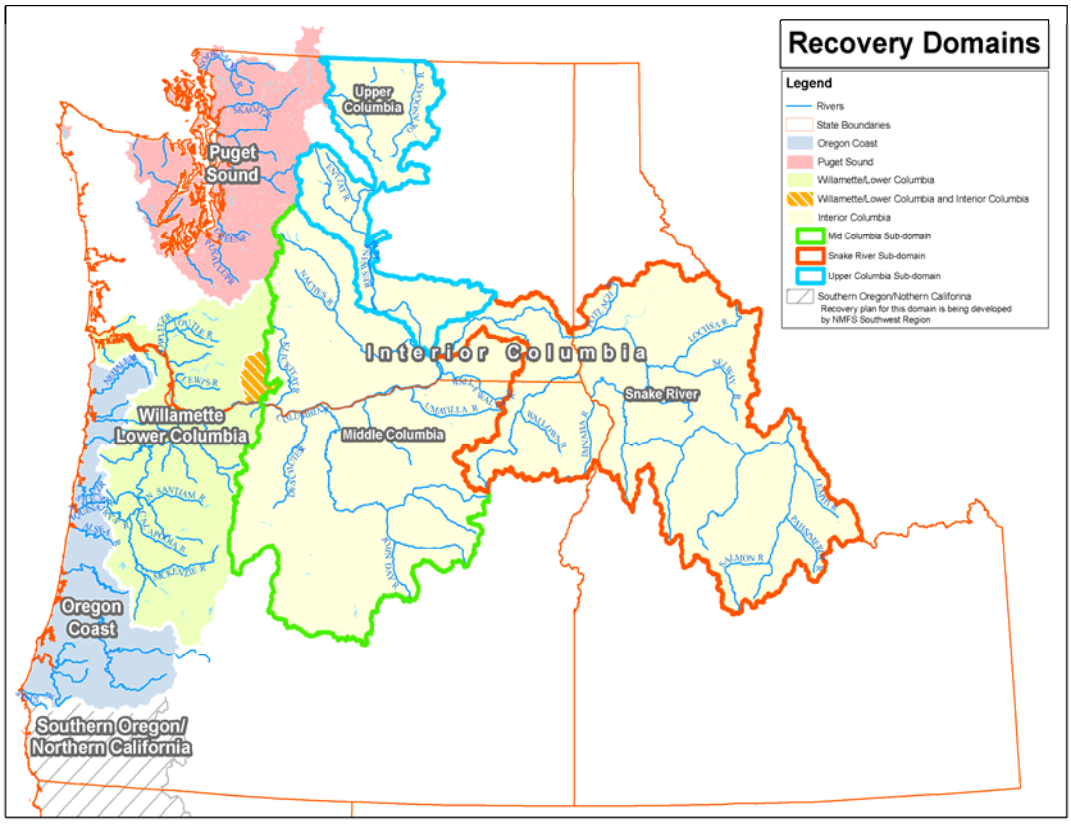

Figure 1. Recovery Domains in the Pacific Northwest

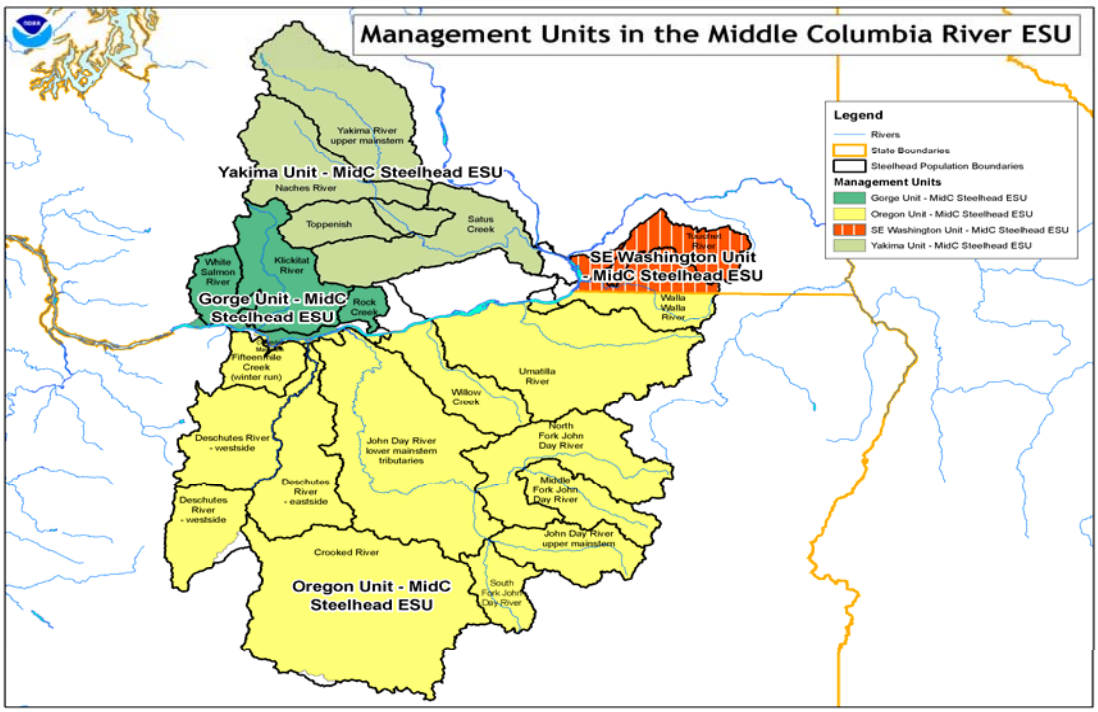

Figure 2. Management Units for the Middle Columbia River Steelhead ESU.

ESU-Level Plans

The separate management unit plans will be "rolled up" or consolidated into one recovery plan for each ESU. Roll up will involve participation by representatives from all the management units and other appropriate representatives from habitat, hydropower, harvest, and hatchery interests (All H sectors). ESU-level interdependencies, such as recovery criteria, recovery scenarios, out-of-subbasin effects, all-H life cycle analyses, and research, monitoring and evaluation strategies, will be addressed during roll up. It is anticipated that participants will describe and agree to an integration of ESU-level recovery actions for the various ESUs. The final ESU-level recovery plans will incorporate the management unit plans.

Technical Recovery Teams

For each domain, NMFS has appointed an independent technical recovery team (TRT) that has geographic and species expertise for the domain and can provide a solid scientific foundation for recovery plans. The charge of each TRT is to develop recommendations on biological viability criteria for ESUs and populations, to provide scientific support to local and regional recovery planning efforts, and to scientifically evaluate recovery plans. The TRTs include biologists from NMFS, state, tribal, and local agencies, academic institutions, and private consulting groups.

All TRTs use the same biological principles for developing their ESU and population viability criteria, principles described in a NMFS technical memorandum, *Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units* (McElhany et al. 2000). Viable salmonid populations (VSP) are defined in terms of four parameters: abundance, population productivity or growth rate, population spatial structure, and life history and genetic diversity. Each TRT's recommendations are based on the VSP framework, as well as on considerations regarding data availability, the unique biological characteristics of the ESUs and habitats in the domain, and the members' collective experience and expertise. NMFS has encouraged the TRTs to develop regionally specific approaches for evaluating viability and identifying factors limiting recovery, but each TRT is working from a common scientific foundation to ensure that the recovery plans are scientifically sound and based on consistent biological principles.

In each domain, NMFS has worked with state, tribal, local, and other Federal stakeholders to support a planning forum appropriate to the domain and management unit, building to the extent possible on ongoing, locally led efforts. Groups in these planning forums use the work of the TRTs and other technical products to agree on recommendations for recovery goals, to assess limiting factors, and then to develop locally appropriate and locally supported recovery actions needed to achieve recovery goals. While these groups also work from a consistent set of assumptions regarding needed recovery plan elements, the process by which they develop those elements, and the form they take, may differ among domains and management units. Subbasin plans, local watershed assessments and conservation plans, and tribal plans serve as building blocks for recovery plans.

NMFS Supplements to Recovery Plans

Once a locally developed recovery plan or management unit plan is completed and transmitted to NMFS, NMFS reviews it and writes a "supplement" describing how the plan addresses ESA requirements for recovery plans. The supplement also proposes ESA delisting (recovery) criteria for the ESUs addressed by the plan, since a determination of these criteria is a NMFS decision. NMFS then will make the supplement and plan available for public review and comment before finalizing an ESA recovery plan.

Middle Columbia Steelhead ESU

Historically, steelhead were abundant in Interior Columbia River streams, including the Gorge Management Unit. For hundreds of years these fish were a thriving part of the region's ecology, culture, and commerce. Over the past 100 years, however, increasing human population in the Columbia River Basin and the associated development and resource use, combined with natural disturbances and climate cycles, has driven some populations to extinction and others to the point where their continued persistence is in doubt. The Middle Columbia steelhead ESU was listed as threatened under the ESA on March 25, 1999 (64 FR 14517).

The Middle Columbia steelhead ESU includes all naturally spawned steelhead populations in streams within the Columbia River Basin from above the Wind River in Washington and the Hood River in Oregon (exclusive), upstream to, and including, the Yakima River in Washington, excluding steelhead from the Snake River Basin (64 FR 14517; March 25, 1999). Stream systems in the ESU's range include Rock Creek and the White Salmon, Klickitat, and Yakima Rivers on the northern side of the Columbia and Fifteenmile Creek and the Deschutes, John Day, Umatilla, and Walla Walla Rivers on the southern side.

This report concerns only a portion of the range of the ESU, and only the Middle Columbia steelhead populations from three Columbia River tributaries, i.e., White Salmon River, Klickitat River, and Rock Creek, which enter the Columbia Gorge from the north side of the Columbia River. The basins drained by these rivers make up the Gorge Management Unit, delineated by NMFS for purposes of recovery planning.

Gorge Management Unit Geography

The three river systems in the Gorge Management Unit begin in the Cascade Mountains of south central Washington and drain a total of more than 1,960 square miles. The White Salmon River enters the Columbia River at Underwood, Washington (RM 168.3). The Klickitat River ─ the largest of the three and one of the longest undammed rivers in the Northwest ─ joins the Columbia at Lyle, Washington (RM 180.4), 34 miles upstream of Bonneville Dam. Rock Creek, which consists of several small watersheds, joins the Columbia at RM 230, about 12 miles upstream of John Day Lock and Dam.

Streams in these systems share similar geomorphic characteristics. Headwater tributaries flow out of forested mountain areas, across basalt plateaus, and through steep walled canyons before reaching their mouths. The White Salmon and Klickitat rivers display notable waterfalls that create partial or complete barriers to anadromous fish migration. On the White Salmon River, a series of falls at RM 16.3, the largest being 21 feet high, stop all further anadromous fish passage. The Klickitat has two large falls; Lyle Falls (RM 2.2), a series of five falls ranging from 4 to 12 feet in height, and Castille Falls (RM 64 to 64.5), a series of 11 falls having a total elevation change of about 80 feet that create a partial barrier to steelhead migration. No known falls in the Rock Creek subbasin block steelhead movement.

Vegetation in the subbasins reflect their location in a transitional environment. Forests cover large portions of the watersheds, particularly the western portions, while the more arid eastern regions generally support sagebrush steppe and grasslands. Half of the White salmon subbasin lies within the Gifford Pinchot National Forest and is managed for timber production and recreation. Forests cover about three-quarters of the Klickitat watershed, with the Yakama Nation being the primary timberland landowner. Forests cover about half the Rock Creek subbasin and are mainly in private ownership. All or parts of the three watersheds reside in Klickitat County.

Plan Development for Gorge Management Unit

A draft interim regional recovery plan for the Gorge Management Unit of the Middle Columbia steelhead ESU is in development. NMFS is leading the effort in partnership with the Yakama Nation, the Washington Department of Fish and Wildlife (WDFW), and the Klickitat County Lead Entity, a voluntary organization under contract with WDFW. A draft recovery plan for the entire Middle Columbia steelhead ESU is expected to be completed in December 2006. NMFS biologists will write the draft plan, with major contributions from the ICTRT and the partners, as follows.

Recovery Criteria

In 2002, NMFS convened a group of scientists to be the Interior Columbia Basin Technical Recovery Team (ICTRT) for the Middle Columbia River steelhead ESU. The ICTRT is made up of biologists from federal and state agencies, the Columbia River Inter-Tribal Fish Commission, and public universities. A list of members and other information relating to the ICTRT is available at the following website: http://www.nwfsc.noaa.gov/trt/trt_pop_id.htm. ICTRT meeting agendas and minutes are available at http://publicnwfsc.afsc.noaa.gov/trt/index.html.

The ICTRT completed a draft report, *Independent Populations of Chinook, Steelhead, and Sockeye for Listed Evolutionarily Significant Units within the Interior Columbia River Domain,* July 2003. The population delineation was updated in May 2005. Copies of these reports, as well as supporting maps, can be found at: http://www.nwfsc.noaa.gov/trt/trt_columbia.htm.

The ICTRT delineated a total of 18 independent populations in the Middle Columbia River steelhead ESU (Figure 3), and three historical independent populations of these fish in the Gorge Management Unit:

- The White Salmon historical steelhead population is a summer run that once spawned and reared in the White Salmon subbasin up to RM 16.

- The Klickitat steelhead population resides in the Klickitat subbasin and exhibits winter and summer life history characteristics.

- The Rock Creek steelhead population spawns and rears in the Rock Creek subbasin and is a summer run.

These populations are part of the Cascades Eastern Slope Tributaries major population group (MPG). This MPG is one of four large clusters of independent steelhead populations identified in the ESU based on basin topography, habitat similarities, and genetic studies.

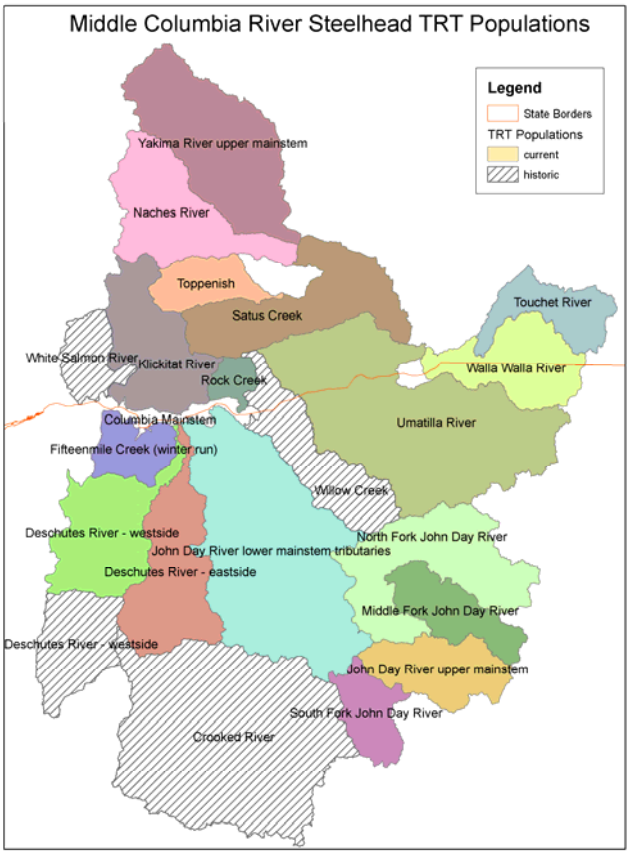

Figure 3. Historical independent steelhead populations in the Middle Columbia River steelhead ESU.

ICTRT Criteria for Assessing Viability

The ICTRT recommended criteria under which the ESU might be considered viable. These criteria are discussed in the draft report entitled *Viability Criteria for Application to Interior Columbia Basin Salmonid ESUs*. The latest draft of this report was released for review by the Columbia River co-managers (Federal, state, and local fishery agencies and tribes) in July 2005. The draft can be found at: http://www.nwfsc.noaa.gov/trt/trt_columbia.htm

The ICTRT's criteria for examining the viability of Middle Columbia River steelhead provide for assessment at the ESU, MPG, and independent population levels. The ICTRT characterized within-population complexity of tributary spawning habitats, assigning each population to one of four general structural categories and estimating the number of relatively large, contiguous production areas within each population. Major spawning aggregations (MSAs) were defined as a system of one or more branches that contains sufficient habitat to support 500 spawners. Contiguous production areas capable of supporting between 50 and 500 spawners were defined as minor spawning area (mSAs).

The ICTRT assigned each population in the ESU to a size category based on total amount of weighted spawning habitat and then gave it a complexity rating based on the estimated

relative distribution of historical spawning habitat. They assigned the three Gorge Management Unit populations to the following categories:

Population	Weighted Area Category	Complexity	
		Category	#MSAs/(#mSAs)
White Salmon (ext)	Intermediate	A	1
Klickitat River	Large	B	5 (6)
Rock Creek	Basic	A	1 (0)

The ICTRT is currently using its recommended viability criteria to assess the status of all of the independent populations and major population groups in the ESU. This effort includes examining the status of the three independent populations in the Gorge Management Unit and their influence on the viability of the Cascades Eastern Slope Tributaries MPG.

Recovery Scenarios

NMFS, in collaboration with stakeholders and the TRT, will recommend and evaluate potential ESU recovery scenarios that include steelhead population abundance and productivity targets that would represent the achievement of overall ESU viability and broad sense recovery goals (meeting long-term goals for economic, environmental and societal benefits). Ultimately, one recovery scenario will be selected and will become the basis for identifying actions for steelhead recovery.

Limiting Factors and Threats Analysis

The Klickitat County Lead Entity completed a watershed-level strategy for salmon recovery in September 2005. Information in the strategy was used to identify limiting factors, threats, and potential recovery actions for the White Salmon and Klickitat steelhead populations. The strategy is available at: http://www.iac.wa.gov/srfb/leadentities.htm.

The recovery plan for the Gorge Management Unit will include limiting factors and threats analyses. Draft lists of limiting factors and threats were compiled at the scale of major spawning areas for the three independent populations, based on information from subbasin plans, the Klickitat Lead Entity's Salmon Recovery Strategy (2003), an ICTRT internal discussion draft report, and the Yakama Nation staff (Appendix A). These lists will be reviewed and revised to reflect comments from the ICTRT, State of Washington, local watershed councils, Yakama Nation, and other stakeholders. Appendix A contains maps of the independent populations and potential spawning areas, as well as tables showing limiting factors, threats, effects on viability, life stages affected and potential management actions for the three independent populations.

Site-Specific Management Actions

NMFS is working with local, state, and Federal agency representatives and the Yakama Nation to identify site-specific management actions to achieve recovery objectives. These management actions would be carried out by state, Federal, tribal, and local jurisdictions, private landowners and companies, and other citizens. Ultimately, the ESU-level recovery plan will address habitat, harvest, hatcheries, and hydro-related actions and describe the management programs and forums in which actions will be identified. Developing an "integrated" plan for management of hatcheries, harvest, and habitat to achieve desired salmon population responses will involve technical and policy comparisons of actions in one sector with different combinations of actions in the other "Hs." Isolated vs. integrated actions will be compared, both within and between sectors. Federal land management actions will be identified, as well as actions in other Federal agencies. The plan will also describe research, monitoring, and evaluation needs.

Estimates of Time and Cost

NOAA's Northwest Fisheries Science Center will provide guidance to the NMFS Regional Office about how to develop time and cost estimates for management actions in recovery plans.

Schedule for Regional Recovery Plan

A draft Middle Columbia steelhead regional recovery plan will be produced by December 2006 for public review and comment. The table below shows key milestones and products in the recovery planning process for the Middle Columbia River steelhead ESU.

Task	Expected Product	Expected Date
Complete Draft Gorge Management Unit Recovery Plans	Draft Recovery Plans	April 15, 2006
ESU Roll-up of Draft Management Unit Recovery Plans	Draft Middle-C Recovery Plan	August 15, 2006
Develop Supplement/FRN for web-posting	Middle-C Steelhead Supplement/FRN	December 15, 2006

Contacts for Additional Information

Additional information about NMFS' salmon recovery activities and recovery plan products is located at http://www.nwr.noaa.gov/Regional-Office/Salmon-Recovery/index.cfm.

References

ICTRT (Interior Columbia Basin Technical Recovery Team). July 2003. Independent populations of Chinook, steelhead, and sockeye for listed evolutionarily significant units within the Interior Columbia River Domain. Northwest Fisheries Science Center, National Marine Fisheries Service, Seattle, Washington. Updated May 11, 2005. Available at:
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NPCC (Northwest Power and Conservation Council). 2004. White Salmon Subbasin Plan. Portland, Oregon.

Acronyms and Abbreviations

ESA	U.S. Endangered Species Act
ESU	evolutionarily significant unit
NMFS	National Marine Fisheries Service
NPCC	Northwest Power and Conservation Council
TRT	Technical Recovery Team
VSP	viable salmonid population
WDFW	Washington Department of Fish and Wildlife

Glossary

This glossary is provided to help new readers differentiate between a number of terms related to types of plans, goals, and spatial scales relevant to recovery planning for salmon and steelhead in the Willamette and Lower Columbia River Basins.

De-listing criteria (also called recovery criteria): Criteria incorporated into ESA recovery plans that, when met, would result in a determination that a species was no longer threatened or endangered and could be proposed for removal from the Federal list of threatened and endangered species.

ESA recovery plan: A plan to recover a species listed as threatened or endangered under the U.S. Endangered Species Act. Plans must, at a minimum, contain (1) site-specific management actions necessary to achieve the plan's goal; (2) objective, measurable criteria which, when met, would result in a determination that the species should be removed from the list; and (3) estimates of the time required and cost to carry out the measures needed to achieve the plan's goal.

Evolutionarily significant unit (ESU): A group of Pacific salmon or steelhead trout that is (1) substantially reproductively isolated from other nonspecific units and (2) represents an important component of the evolutionary legacy of the species.

Extirpated: A species that no longer exists in the wild in one geographic region but does still exist in other places.

Independent population: Any collection of one or more local breeding units whose population dynamics or extinction risk over a 100-year time period is not substantially altered by exchanges of individuals with other populations.

Interim regional recovery plan: A recovery plan that is intended to lead to an ESA recovery plan but that is not yet complete. These plans might address only a portion of an ESU or lack other key components of an ESA recovery plan.

Limiting factor: Physical, biological, or chemical features (e.g., inadequate spawning habitat, high water temperature, insufficient prey resources) experienced by the fish at the population, intermediate (e.g., stratum or major population grouping), or ESU levels that result in reductions in viable salmonid population (VSP) parameters (abundance, productivity, spatial structure, and diversity). Key limiting factors are those with the greatest impacts on a population's ability to reach its desired status.

Locally developed recovery plan: A plan developed by state, tribal, regional, or local planning entities to address recovery of a species. These plans are being developed by a number of entities throughout the region to address Endangered Species Act as well as state, tribal, and local mandates and recovery needs.

Management unit: A geographic unit delineated by NMFS for purposes of recovery planning. A management unit is a portion of the spawning and rearing range of an ESU that roughly follows jurisdictional or management boundaries of state, tribal, or local entities. Taken together, all the management units for an ESU define its total spawning and rearing range.

Recovery domain: An administrative unit for recovery planning defined by NMFS based on ESU boundaries, ecosystem boundaries, and existing local planning processes. Recovery domains may contain one or more listed ESUs. NMFS intends to develop one recovery plan that addresses all listed ESUs within a domain.

Recovery goals: Goals incorporated into a locally developed recovery plan. These goals may go beyond the requirements of ESA de-listing by incorporating goals that address other legislative mandates or social values.

Recovery plan supplement: A NMFS supplement to a locally developed recovery plan that describes how the plan addresses ESA requirements for recovery plans. The supplement also proposes ESA de-listing criteria for the ESUs addressed by the plan, since a determination of these criteria is a NMFS decision.

Recovery scenarios: Scenarios that describe a target status for each population within an ESU, generally consistent with TRT recommendations for ESU viability.

Recovery strategies: Broad sets of actions that address limiting factors and threats and would lead to achieving recovery goals or de-listing criteria.

Technical Recovery Team (TRT): Teams convened by NMFS to develop technical products related to recovery planning. TRTs are complemented by planning forums unique to specific states, tribes, or regions, which use TRT and other technical products to identify recovery actions.

Threats: Human activities or natural events (e.g., road building, floodplain development, fish harvest, hatchery influences, volcanoes) that cause or contribute to limiting factors. Threats may be caused by the continuing results of past events and actions as well as by present and anticipated future events and actions.

Viability criteria: Criteria based on the VSP parameters of abundance, productivity, spatial structure and diversity that describe a viable salmonid population (an independent population with a negligible risk of extinction over a 100-year time frame) and that describe a general framework for how many and which populations within an ESU should be at a particular status for the ESU to have an acceptably low risk of extinction.

Viable salmonid population (VSP): an independent population of Pacific salmon or steelhead trout that has a negligible risk of extinction over a 100-year time frame. Viability at the independent population scale is evaluated based on the parameters of abundance, productivity, spatial structure, and genetic diversity.

Appendix A – Limiting Factors and Threats

Limiting Factors and Threats for White Salmon River Steelhead

Condit Dam, at river mile (RM) 3.3, is the most significant factor limiting Middle Columbia River steelhead production in the White Salmon subbasin. Since 1913, the dam has blocked steelhead and coho passage to the majority of historical spawning and rearing habitat in the MSA and restricted the population to the 3.3-mile reach below the dam. Although Middle Columbia River steelhead are currently classified as extirpated above Condit Dam, historical steelhead habitat in the White Salmon subbasin below RM 16 has been identified as a (potential) major spawning area. Available habitat in the lower river, while not monitored, is believed to support 20 to 50 natural steelhead spawners (NPCC 2004). Removal of the dam is scheduled to begin in October 2008 and to be completed by May 2009.

Steelhead production – and potential production once passage is restored – is also limited by habitat alterations in the subbasin that have resulted in reduced habitat quality, altered flow regimes, sedimentation, and elevated stream temperatures. These changes also have contributed to increased predation and competition (NPCC 2004). The population is affected during all life stages, but particularly during spawning, egg incubation, fry colonization, and juvenile rearing.

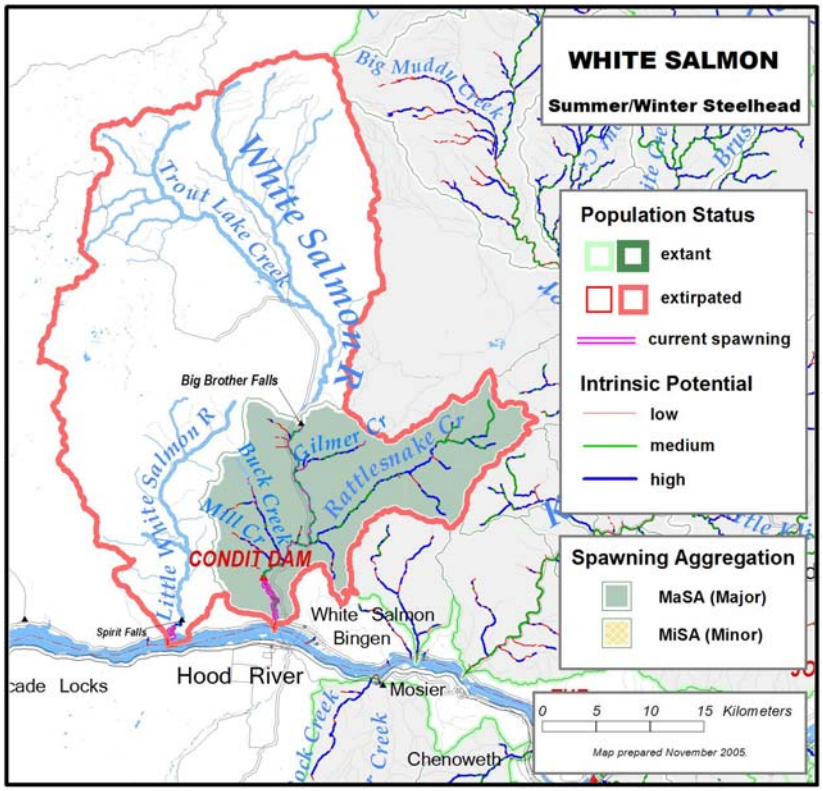

Figure A-1. Potential spawning aggregations (MSAs and mSAs) for Middle Columbia steelhead in the White Salmon Subbasin

Table A-1. Limiting factors for Middle Columbia River steelhead in White Salmon MSA.[2]

Limiting Factor	VSP Parameter Impacted	Location of Impacts	Threats	Life stages affected	Significance (Scope/Severity)	Assumptions & Uncertainties	Actions to address
Blocked migration	Reduction in abundance, population growth rate, spatial structure and diversity	RM 3.3 of mainstem White Salmon River	Condit Dam	All stages	Passage blocked to 26 miles of historical spawning and rearing habitat.	VSP parameters would improve with passage at Condit Dam	Remove Condit Dam
Impaired passage conditions	Reduction in abundance, population growth rate, spatial structure and diversity	Upstream of Condit Dam, manmade barriers occur at RM 3.8 on Buck Cr. And RM 0.7 on Spring Cr.	unscreened diversions, culverts, lost connectivity from habitat degradation	Spawning, rearing migration	Potential entrainment of fish at diversions	VSP parameters would improve with passage at Condit Dam	Screen diversions on Buck Creek and elsewhere; provide passage over manmade irrigation dams and other manmade obstacles.
Altered flow regimes		1.1 mile bypass reach mainstem; Buck & Rattlesnake Crs.	Increased run-off from roads, forests, ag. Lands; flows too low in 1.1-mile bypass reach; lack of connectivity with floodplain; loss of wetlands.	Fry colonization, inactive age-0 and 1, adult holding and spawning, rearing, migration	Increased peak flows in tributaries. Estimated 10% increase in peak flow at the Underwood Gauge (RM2). Ag. Diversion withdraws 70% of flow from Buck Creek, unused portion returns to White Salmon via gully (Klickitat Lead Entity 2005).	Floodplain and wetland restoration will slow runoff and improve groundwater recharge.	Improve flow regime; restore wetlands, floodplain connectivity and other water holding capacity.
Lack of LWD		1.1 mile of bypass reach on mainstem, Buck Creek to Husum on mainstem, Buck Creek	Reduced habitat diversity, riparian/floodplain function, reduced pools for rearing	Fry colonization, juvenile rearing, overwintering Prespawners, spawners	Lack of LWD limits development of pools and sorting of gravel.	Wood restoration will increase rearing habitat by forming pools, improve sediment sorting, and provide greater habitat complexity.	Place LWD as appropriate and feasible. Address removal of wood by boaters.
Channel stability, Bed scour		RM 3.3 to mouth; Rattlesnake Cr.	Reduced habitat quality and riparian/floodplain function from road densities, logging and land conversion to agriculture and residential	Egg incubation, Fry colonization, inactive age-0 and 1	Channel downcutting simplifies habitat, reduces connectivity with floodplain, increases sediment load. Increased peak flows in tributaries. Estimated 10% increase in	Restoring wetland and floodplain connectivity will provide more capacity for flood flows, reduce bed scour and slow runoff.	Restore floodplain connectivity. Place LWD as appropriate. Add structure to form pools.

[2] NMFS staff compiled this discussion-draft information from (1) the White Salmon Subbasin Plan, Northwest Power and Conservation Council 2004; (2) Klickitat Lead Entity Salmon Recovery Strategy; and (3) Yakama Nation staff.

Limiting Factor	VSP Parameter Impacted	Location of Impacts	Threats	Life stages affected	Significance (Scope/Severity)	Assumptions & Uncertainties	Actions to address
					peak flow at the Underwood Gauge (RM2)		
Elevated stream temperatures		RM 3.3 to 5.0 mainstem; Buck, Rattlesnake, Indian Creeks	Loss of riparian function, altered flow regimes, water diversions	Juvenile rearing, active age-0, spawning, migration		Conifers in riparian areas will provide shade and reduce temperatures.	Riparian conversion project needed to establish conifers; improve base flow
Fine sediments		Mouth to Condit Dam; Rattlesnake Creek	Road densities, bank instability, dam removal	Spawning, egg incubation, fry colonization, inactive age-0 and 1, rearing and migration	Dam removal is expected to cause short-term high sediment volume. Loss of floodplain connectivity increased erosion, bed scour.	With removal of dam, exposed banks could become unstable.	Upon Dam removal, assess restoration needs; restore LWD and floodplain connectivity
Harassment, Predation and competition			Inundation by Bonneville Pool, loss of riparian function , release of hatchery steelhead	Adult migrants, prespawners, holding,	Increase in exotic species and recreational activity in lower river.		
Predation and competition			Release of hatchery steelhead	Adults and juveniles	Incidental take during fisheries targeting hatchery steelhead is low		

Limiting Factors and Threats for Klickitat River Steelhead

The ICTRT has identified five historical major spawning areas (MSA) for the Klickitat steelhead population: Upper Klickitat, Trout Creek, Upper White, Brush, and Little Klickitat (ICTRT, internal discussion draft, December 2005). Middle Columbia steelhead occupy all of these major spawning areas. Current steelhead spawning distribution in the Klickitat mainstem is concentrated between RM 5 and RM 50, with occasional spawning above Castile Falls (RM 64). Tributary spawning occurs in the White Creek watershed (including Tepee and Brush Creeks), Dead Canyon, Swale Canyon, Wheeler, Summit, and lower Bowman creeks, the lower (and occasionally upper) Little Klickitat River, and other smaller tributaries. Winter steelhead are believed to spawn between the confluence of the Columbia River and the Little Klickitat confluence.

A number of natural migration barriers in the watershed limit production of Klickitat River steelhead. The most significant natural barriers include Lyle Falls (RM 2.2), Castile Falls (RM 64) and Little Klickitat river Falls (RM 6.1). Steelhead viability is also limited by habitat alterations in the subbasin that have resulted in reduced habitat quality, altered flow regimes, high fine sediment loads and elevated stream temperatures. The population is affected during all life stages.

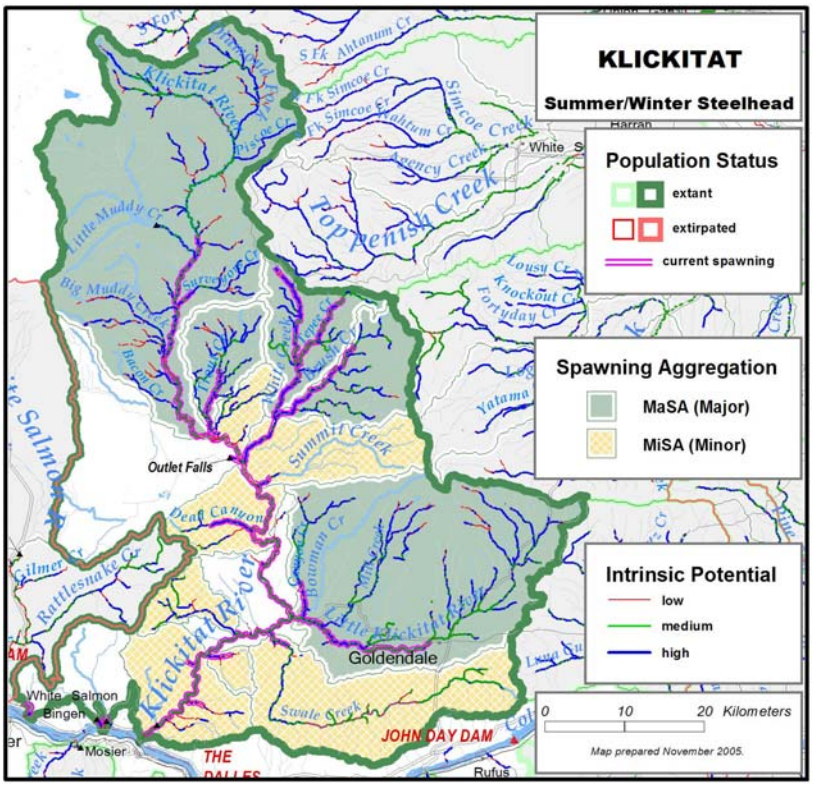

Figure A-2. Klickitat River Steelhead Major and Minor Spawning Aggregations

Table A-2. Limiting factors for Middle Columbia River steelhead in Upper Klickitat MSA.[3]

Limiting Factor	VSP Parameter Impacted	Location of Impacts	Threats	Life stages affected	Significance (Scope/Severity)	Assumptions/ Uncertainty	Actions to Address
Stream simplification; reduced habitat complexity, including lack of pools; high fine sediments	Primarily abundance and productivity	Upper Klickitat, McCreedy Creek to Diamond Fork		Spawning, rearing, migration	High potential for productivity if restored.	Restoration of wood will increase rearing habitat through pool formation, improved sediment sorting, and increased cover habitat and greater habitat complexity.	Place LWD to increase rearing habitat.
Restricted access to floodplain habitats.	Abundance, productivity, spatial structure	Upper Klickitat, McCreedy Creek to Diamond Fork		Spawning, rearing, migration		Realignment of road will reduce sediment inputs and widen the channel, reducing water velocities during peak flow events.	Realign stream to distance channel from road.
Increased peak flow due to confinement of channel by road.	Primarily abundance and productivity	Upper Klickitat, McCreedy Creek to Diamond Fork		Spawning, rearing, migration		Perforation of road where realignment is impractical will attenuate peak flow by allowing waters to move onto floodplain.	Perforate road to allow peak flows to move onto floodplain.
Reduced riparian vegetation; secondary channels disconnected from main; lack of LWD and habitat complexity	Abundance, productivity, spatial structure	Upper Klickitat, Diamond Fork to headwaters	historical grazing activities caused channel widening and incision	Spawning, rearing, migration	Potential exists for additional production	Phase 2 meadows restoration project in progress. Actions will increase available rearing area	Reconnect secondary channels. Place LWD or other structures to stop headcutting of erosion areas that threaten to capture the stream. Vegetate riparian areas.
Lost habitat complexity, channel widening and incision, loss of riparian vegetation, lack of pools, reduced LWD	Primarily abundance and productivity	Upper Klickitat, Diamond Fork Basin		Spawning, rearing, migration	Expected high production once areas are restored		Place LWD or other structures to stop headcutting of erosion areas that threaten to capture the stream. Vegetate riparian areas.
ORV trails impinge on the channel and threaten to capture and realign the stream	Primarily abundance and productivity	Upper Klickitat, Diamond Fork Basin	ORV trails adjacent to the stream channel.	Spawning, rearing, migration		Control of ORV use in the area will reduce erosion contributing sediment to stream the potential effects on the channel.	Control use of unauthorized ORV trail.
Elevated fine sediments clog spawning gravels and reduce survival of eggs and alevins.	Primarily abundance and productivity	Upper Klickitat, Diamond Fork Basin		Fine sediments clog spawning gravels and reduce survival of eggs and alevins.		Will reduce sediment in spawning gravels and increase productivity of spawning beds.	Reduce road/stream interactions by controlling surface erosion and potential for road related landslides

[3] NMFS staff compiled this discussion-draft information from the following sources: (1) Klickitat Subbasin Plan, Northwest Power and Conservation Council, 2004; (2) Klickitat Lead Entity Salmon Recovery Strategy; and (3) Yakama Nation staff.

Table A-3. Limiting factors for Middle Columbia River steelhead in Trout Creek MSA. No information yet for Trout Creek.

Limiting Factor	VSP Parameter Impacted	Location of Impacts	Threats	Life stages affected	Significance (Scope/Severity)	Assumptions/ Uncertainty	Actions to Address

Table A-4. Limiting factors for Middle Columbia River steelhead in Upper White Creek MSA.[4]

Limiting Factor	VSP Parameter Impacted	Location of Impacts	Threats	Life stages affected	Significance (Scope/Severity)	Assumptions/ Uncertainty	Actions to Address
Lack of LWD; downcutting of the channel bed; loss of channel roughness, habitat complexity; cover habitat along the bank margins is poor in some areas.	Primarily abundance and productivity	Upper White drainage		Spawning, rearing migration Rearing habitat is believed to be most limiting factor within White Creek	The White Creek watershed accounts for roughly 40% of total steelhead spawning within surveyed areas of the Klickitat River Basin.	Actions would increase suitable rearing habitat; restore channel roughness and complexity to better handle peak flows and augment base flows; increase pool abundance and rearing capacity; improve sorting of sediments and gravel retention.	Place LWD or other structures in channel. Plant/ restore conifers in riparian zone.
Loss of floodplain connectivity, with related reduced groundwater recharge and low flows. Some reaches going dry seasonally.	Primarily abundance and productivity	Upper White drainage	Roads	Rearing and migration		Channel incision and bed degradation in meadow areas has resulted in a loss of connectivity to flood plain and more pronounced peak flows	Restore floodplain connection of incised reaches by raising channel invert of excavating new floodplain. Reduce connectivity of roads to streams to reduce peak flows.
Lack of spawning gravel; low pool frequency and volume; other velocity refugia	Primarily abundance and productivity	Upper White drainage		Spawning and rearing		LWD and other structure will capture and sort gravel.. Habitat within the channel is affected by lack of in-channel structure. Sediments	Install LWD and other structure

[4] NMFS staff compiled this discussion-draft information from the following sources: (1) Klickitat Subbasin Plan, Northwest Power and Conservation Council, 2004; (2) Klickitat Lead Entity Salmon Recovery Strategy; and (3) Yakama Nation staff.

Limiting Factor	VSP Parameter Impacted	Location of Impacts	Threats	Life stages affected	Significance (Scope/Severity)	Assumptions/ Uncertainty	Actions to Address
areas limited.						in bed have shifted towards larger material.	
Culverts block migration	Abundance, productivity, spatial structure, and diversity	Mainstem White Creek		Spawning, rearing migration. Culverts block primarily juvenile and some adult upstream migration and access to habitat in some areas.	Three culverts remain that impede upstream migration of juveniles, important in this area due to low flow situations further downstream. Several miles of spawning and rearing habitat are available upstream of these culverts.	Action improves juvenile fish access to existing upstream habitat.	Remove/repair barrier culverts

Table A-5. Limiting factors for Middle Columbia River steelhead in Brush Creek MSA.[5]

Limiting Factor	VSP Parameter Impacted	Location of Impacts	Threats	Life stages affected	Significance (Scope/Severity)	Assumptions/ Uncertainty	Actions to Address
Lack of LWD; downcutting of the channel bed; loss of channel roughness, habitat complexity; cover habitat along the bank margins is poor in some areas.	Primarily abundance and productivity	Brush Creek drainage		Spawning, rearing migration		Actions would increase suitable rearing habitat; restore channel roughness and complexity to better handle peak flows and augment base flows; increase pool abundance and rearing capacity; improve sorting of sediments and gravel retention.	Place LWD or other structures in channel; plant/ restore conifers in riparian zone.
Loss of floodplain connectivity, with related reduced groundwater recharge and low flows. Some reaches going dry seasonally.	Primarily abundance and productivity	Brush Creek drainage		Spawning and rearing		Channel incision and bed degradation in meadow areas has resulted in a loss of connectivity to flood plain and more pronounced peak flows	Restore floodplain connection of incised reaches by raising channel invert of excavating new floodplain. Reduce connectivity of roads to streams to reduce peak flows.

[5] NMFS staff compiled this discussion-draft information from the following sources: (1) Klickitat Subbasin Plan, Northwest Power and Conservation Council, 2004; (2) Klickitat Lead Entity Salmon Recovery Strategy; and (3) Yakama Nation staff.

Limiting Factor	VSP Parameter Impacted	Location of Impacts	Threats	Life stages affected	Significance (Scope/Severity)	Assumptions/ Uncertainty	Actions to Address
Lack of spawning gravel; pools and other velocity refugia areas limited.	Primarily abundance and productivity	Brush Creek drainage		Spawning and rearing		Habitat within the channel is affected by lack of in-channel structure. Sediments in bed have shifted towards larger material.	Restore channel

Table A-6. Limiting factors for Middle Columbia River steelhead in the Little Klickitat MSA.[6]

Limiting Factor	VSP Parameter Impacted	Location of Impacts	Threats	Life stages affected	Significance (Scope/Severity)	Assumptions/ Uncertainty	Actions to Address
High stream temperatures; lack of trees in riparian area to provide shade; fine sediments affect channel complexity and stream temperatures	Abundance, productivity, spatial structure, diversity	Little Klickitat subbasin to RM 6.1 plus Canyon Creek to waterfall.	Harvest, roads, grazing	Spawning, rearing, migration	Lower 6.1 miles provide spawning and rearing habitat. Steelhead use of upper subbasin is unknown. Lower subbasin tributaries historically provided the majority of wild steelhead spawning and rearing habitat in MSA. Stream temperatures exceed state standards throughout much of subbasin.	Shade will reduce temperatures, benefiting fish and helping to attain TMDLs.	Plant trees in riparian areas. Reduce fine sediment inputs Restore floodplain connectivity Assess spatial distribution of cool water inputs to identify existing refugia.
Reduced pool habitat, LWD and low flows	Primarily abundance and productivity	Little Klickitat subbasin		Rearing		Created pools will provide rearing habitat	Place wood to add structure. Restore pool habitat.
Culverts block passage	Spatial structure, abundance, productivity	Little Klickitat subbasin	Roads	Migration, spawning, rearing		Action will provide access to habitat	Replace culverts that are blocking passage
Unknown passage frequency	Spatial structure, abundance, productivity, diversity	falls		Migration, spawning, rearing	Understanding on the frequency that steelhead pass above falls at RM 6.1 is limited.	Action will provide needed information about passage to areas above falls.	Assess frequency that steelhead pass the falls under various flow conditions

[6] NMFS staff compiled this discussion-draft information from the following sources: (1) Klickitat Subbasin Plan, Northwest Power and Conservation Council, 2004; (2) Klickitat Lead Entity Salmon Recovery Strategy; and (3) Yakama Nation staff.

Limiting Factors and Threats for Rock Creek Steelhead

The Rock Creek watershed is considered a major spawning area. The watershed is sparsely populated, but anthropogenic influences occur throughout the subbasin. Most of the area has been heavily grazed and primitive roads are present from near the Columbia River to the headwaters of most streams in the subbasin. Beaver that were once likely abundant are now all but absent. Despite these alterations, considerable forest canopy remains and most stream reaches support at least shrub-dominated riparian areas.

The most significant factors limiting steelhead production in the watershed are low summer base flows, high summer stream temperatures, absence of large pool habitats, lack of large woody debris, and sedimentation. Grazing and forest roads are significant contributors to habitat problems in the watershed. Together, these and other uses have altered basin hydrology and destabilized some stream channels. The loss of beaver has probably exacerbated these problems. Table A-7 displays the factors and threats limiting steelhead production in the Rock Creek subbasin.

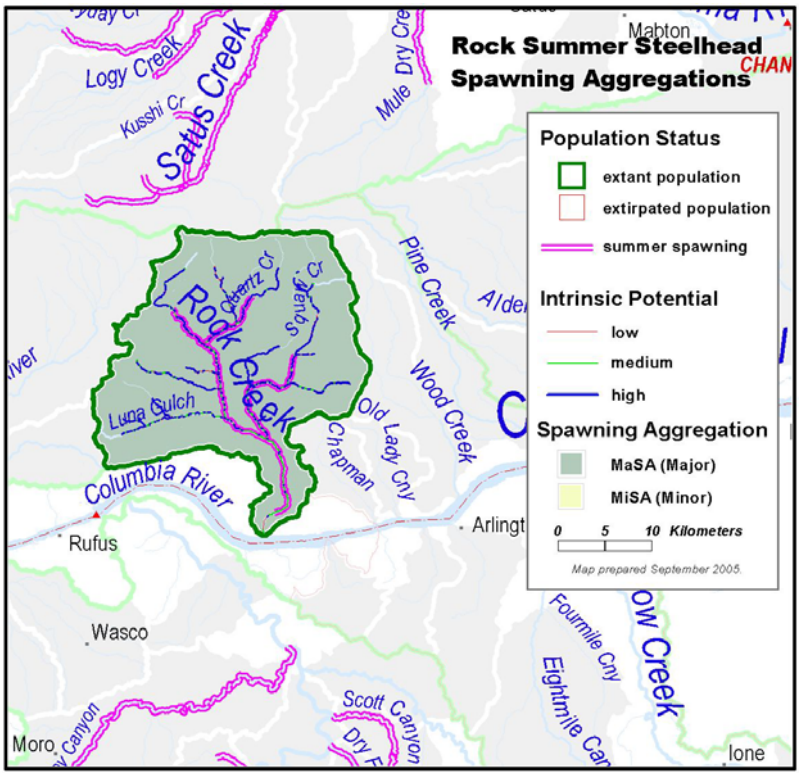

Figure A-3. Rock Creek steelhead major and minor spawning aggregations.

Table A-7. Limiting factors for Middle Columbia River steelhead in Rock Creek MSA[7]

Limiting Factor	VSP Parameter Impacted	Location of Impacts	Threats	Life stages affected	Significance (Scope/Severity)	Assumptions/Uncertainty	Actions to address
Channel structure, stability and complexity	Primarily abundance and productivity	Alluvial valley reaches, lower end of canyon reach, upper Rock Creek	Timber harvest, grazing, cattle watering, roads, flooding, loss of beaver . Rock Creek Road and other infrastructure in watershed have altered floodplain , confined river and tributaries	All stages	Loss of stable instream woody debris and large pool habitat, reduced soil stability, altered habitat composition, decrease in glides.		Increase floodplain and channel roughness, reconnect off-channel habitats and connectivity with floodplain
Lack of LWD	Primarily abundance and productivity	Headwaters, upper plateau, alluvial valley, tributaries, Squaw Cr,	Timber harvest, grazing, roads, wildfire, loss of beaver	All stages	Woody debris is a key element for forming pool habitat, providing overhead cover, sorting spawning gravels, and maintaining channel and bank stability.		Implement appropriate practices which leave sources of LWD to naturally enter and remain in the system. Place LWD in reaches as needed.
Riparian condition and function	Primarily abundance and productivity	Headwaters, lower canyon reach, upper plateau, alluvial valley, Quartz and Squaw creeks	Loss of riparian vegetation and function and stream canopy from timber harvest, overgrazing, roads, wildfire	All stages	Reduced shade from riparian vegetation and large wood recruitment; higher storm flows, bank erosion and fine sediments		Reestablish and/or enhance native vegetation in riparian areas
High summer water temperatures	Primarily abundance and productivity, also spatial structure and diversity	Upper and lower Rock Creek, Squaw Creek	Grazing, timber harvest, episodic flood events, lack of riparian cover and exposed rocky channel	Spawn timing, incubation; juvenile rearing,	Decreased suitable habitat		Reestablish and/or enhance native vegetation in riparian areas
Low to non-existent summer stream flows and high peak flows	Abundance, productivity, spatial structure and diversity	Lower Rock Creek watershed and in some headwater and canyon reaches	Roads, timber harvest, overgrazing, channel incision/widening	All stages	Inadequate instream flow during critical periods.		Implement upland management practices that mimic natural runoff and sediment production.
Embedded substrates;	Primarily	Lower alluvial	High road density; timber	Spawning,			Study and assess

[7] NMFS staff compiled this discussion-draft information from the following sources: (1) Draft Lower Columbia Mainstem Subbasin Plan, Includes Rock Creek, Washington, Northwest Power and Conservation Council, 2004; (2) Klickitat Lead Entity Salmon Recovery Strategy; and (3) Yakama Nation staff.

Limiting Factor	VSP Parameter Impacted	Location of Impacts	Threats	Life stages affected	Significance (Scope/Severity)	Assumptions/Uncertainty	Actions to address
excessive fine sediment	abundance and productivity	areas, headwaters, lower Quartz Cr., Squaw Cr.	harvest; riparian grazing; wildfire.	rearing, egg incubation			sources/attribute relative contributions of fine sediment. Implement off road vehicle management actions that reduce fine sediment inputs.
Predation/harassment	Primarily abundance and productivity	Lower Rock Creek,	loss of riparian function; introduced species and hatchery outplants	Adult migrants, prespawners, holding,			Assess significance of predation by native Birds and other predators
Competition	Primarily abundance and productivity	Lower Rock Creek	Competition with hatchery fish and introduced species for space and food resources	Adults and juveniles			